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U S NAVAL PROVING GROUND
DAHLGREN, VIRGINIA

REPORT NO 1052

FUZZING SYSTEMS: RESEARCH DEVELOPMENT,
TESTS, AND REPORTS OF

Final Report

ELECTRIC BOMB FUZE EX 200 MOD 3
IN 250 LB MODIFIED G P BOMB

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Task
Assignment WPG-Re2b-20-1-52

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Electric Bomb Fuze EX 200 Mod 3 in 250 lb. Modified G.P. Bomb

PART A

SYNOPSIS

1. This test was conducted to determine the air blast pressure and beam spray fragment velocities produced by modified 250 lb. G.P. bombs 80/20 tritonal loaded and assembled with athwartships fuses EX 200 Mod 3 having a 96 gram tetryl booster.

2. a. The EX 200 Mod 3 athwartships fuze as assembled for this test was unsatisfactory in that 3 of the 5 modified 250 lb. G.P. bombs failed to detonate. The failure of the 3 rounds is attributed to the 1/4" air gap separating the tetryl lead-in and the blasting cap.

b. The two bombs that detonated high order produced an average beam spray fragment velocity of 5630 ft./sec. and a peak blast pressure of 8.4 psi at 50 feet from the bombs.

3. It is recommended that separate fuze trials be conducted with no separation between the blasting cap and tetryl lead-in to determine the efficiency of the tetryl lead-in. These tests can be conducted without bombs since, on the basis of previous tests, the booster size is considered adequate to produce high order detonation of the 250 lb. bombs.

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PART B

INTRODUCTION

1. AUTHORITY:

This test was requested by reference (a) and conducted under Task Assignment NPG-Re2b-20-1-52, reference (b).

2. REFERENCES:

- a. NOL Work Request WA-26 to NAVPROV of 6 May 1952
- b. BUORD Conf ltr NP9 Re2b-DBLaP:bjn Ser 23939 of 4 Aug 1951
- c. NPG Conf Report No. 931 of 4 Mar 1952

3. BACKGROUND:

a. In the development and testing of bomb fuzes, the Naval Proving Ground was authorized by reference (b) to work directly with the Naval Ordnance Laboratory. Reference (c) reported the air blast pressures and fragment velocities for the standard 250 lb. G.P. bomb having a nose fuze and modified 250 lb. G.P. bombs having various athwartships fuzes.

b. Reference (a) requested that 5 EX 200 fuzes containing tetryl pellets 2.7506 diameter and .750 thick (96 grams) be tested in the modified 250 lb. bombs to determine the adequacy of these pellets, which will probably be used in the production fuzes. Six tetryl pellets 2.7537 diameter and .07539 thick (70.5 grams) were used in tests reported in reference (c). All six detonated the 250 lb. modified bombs high order indicating that this booster size was adequate.

4. OBJECT OF TEST:

This test was conducted to determine the air blast pressure and beam spray fragment velocities produced by modified 250 lb. G.P. bombs 80/20 tritonal loaded and assembled with athwartships fuzes EX 200 Mod 3 having a 96 gram tetryl booster.

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5. PERIOD OF TEST:

a. Date Project Letter	6 May 1952
b. Date Necessary Material Received	18 June 1952
c. Date Commenced Test	14 July 1952
d. Test Completed	14 July 1952

6. REPRESENTATIVE PRESENT:

This test was witnessed by Mr. N. Butler, representing the Naval Ordnance Laboratory.

PART C

DETAILS OF TEST

7. DESCRIPTION OF ITEM UNDER TEST:

a. Five Electric Bomb Fuzes EX 200:

Five Electric Bomb Fuzes EX 200 were modified for static detonation by Naval Ordnance Laboratory. All fuzes contained a 2.7506 diameter and 0.750 thick tetryl pellet (96 grams), a 0.7160 diameter and 0.371 thick tetryl lead-in, and a special engineers blasting cap. All fuzes were assembled in the field. An air gap of approximately 1/4" existed in the assembled unit between the end of the blasting cap and the tetryl lead-in. The tetryl pellet used in these tests is slightly smaller than the 1/2 size pellet used in previous tests, reference (c).

b. Five Modified 250 lb. G.P. Bombs:

Five standard 250 lb. G.P. Bombs AN-M57 were modified when empty by forming a 3.000 diameter cavity athwartships and inserting a fuze cavity liner 3.000 O.D. and 2.781 I.D., Figure 1. The bombs were modified by Daystrom Electric Corporation and loaded with 80/20 tritonal at the Naval Mine Depot, Yorktown, Va. The weights are as follows:

<u>Rd.</u> <u>No.</u>	<u>Serial</u> <u>No.</u>	<u>Empty</u> <u>(lbs.)</u>	<u>Explosive</u> <u>Wt. (lbs.)</u>	<u>Total Wt.</u> <u>Without Fuze</u>
1	12	119.0	131.0	250.0
2	9	121.0	129.0	250.0
3	18	124.5	128.5	253.0
4	21	122.5	130.0	252.5
5	10	-	-	254.0

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8. DESCRIPTION OF TEST EQUIPMENT:

- a. Three Naval Ordnance Laboratory Indenter Gages
- b. Two 35mm Fastax Cameras
- c. Velocity Plates

9. PROCEDURE:

- a. The indenter gages were placed at ground level 50 feet from the bomb in polar angle zone 135°.
- b. The cameras were placed to record fragment hits on the 15' high velocity plates which were at 60 feet from the bomb in polar angle zone 78°-102°.
- c. The bombs were placed horizontally on a 5' high platform with the nose pointed toward 0°.

10. RESULTS AND DISCUSSION:

a. The first two bombs tested detonated high order and produced beam spray fragment velocities and peak blast pressures comparable with those for previously tested bombs containing similar fuzes. Detailed fragment velocity data are listed in Table I and are summarized with the blast data as follows:

<u>Rd. No.</u>	<u>Average Blast Pressure at 50 Feet (psi)</u>	<u>Beam Spray Fragment Velocity (median)</u>
1	9.0	5450 ft./sec.
<u>2</u>	<u>7.4</u>	<u>5820 ft./sec.</u>
2 Round Average	8.2	5630 ft./sec.
*6 Round Average	8.6	5630 ft./sec.

*Six rounds having 1/3 booster size reported in reference (c).

b. The remaining three bombs did not detonate high order. The fuze lead-ins and boosters of Rounds Nos. 3 and 5 failed to detonate when the blasting caps were initiated. The booster of Round No. 4 detonated low order, and the fuze cavity liner ruptured around the booster location. All fuze parts were ejected from the athwartships column.

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c. The failure of the three rounds to detonate high order can be attributed to the 1/4" air gap between the lead-in and the blasting cap, although if the diameter of the lead-in had been greater, satisfactory performance might still have been attained. Although the lead-in size may be of sufficient size (without the air gap) to detonate the tetryl booster, a crack in the lead-in or its misalignment will greatly decrease its ability to detonate the booster high order.

PART DCONCLUSIONS

11. a. The EX 200 Mod 3 athwartships fuze as assembled for this test was unsatisfactory in that 3 of the 5 modified 250 lb. G.P. bombs failed to detonate. The failure of the 3 rounds is attributed to the 1/4" air gap separating the tetryl lead-in and the blasting cap.

b. The two bombs that detonated high order produced an average beam spray fragment velocity of 5630 ft./sec. and a peak blast pressure of 8.4 psi at 50 feet from the bombs.

PART ERECOMMENDATION

12. It is recommended that separate fuze trials be conducted with no separation between the blasting cap and tetryl lead-in to determine the efficiency of the tetryl lead-in. These tests can be conducted without bombs since, on the basis of previous tests, the booster size is considered adequate to produce high order detonation of the 250 lb. bombs.

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Electric Bomb Fuze EX 200 Mod 3 in 250 lb. Modified G.P. Bomb

The tests upon which this report is based were conducted by:

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NPG REPORT NO. 1052

U. S. NAVAL PROVING GROUND
DAHLGREN, VIRGINIA

Thirty-Sixth Partial Report

on

Bomb Fuzing System;

Research, Development, Tests, and Reports of

Second Partial Report

on

Electric Bomb Fuze EX 200 Mod 3

in 250 lb. Modified G.P. Bomb

Project No.: NPG-Re2b-20-1-52
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Electric Bomb Fuze EX 200 Mod 3 in 250 lb. Modified G.P. Bomb

TABLE I

FRAGMENT VELOCITY DATA

60 Ft. Radius Arena

Date Fired: 14 July 1952

35mm Fastax Camera #1

2550 frames per sec.

Rd. 1, 250 lb. G.F. Bomb

Filler: 80/20 Tritonal

Total Weight: 250.0 Lbs.

Filler Weight: 131.0 Lbs.

<u>Frame in Which Hit Occurred</u>	<u>No. Fragments</u>	<u>Velocity (f/s)</u>
25	4	6120
26	5	5880
27	7	5670
28	6	5460
29	8	5280
30	4	5100
31	1	4940
32	1	4780
34	2	4500
Median		5580
Average		5470

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TABLE I (Continued)

60 Ft. Radius Arena	Date Fired: 14 July 1952
35mm Fastax Camera #2	2430 frames per sec.
Rd. 1, 250 lb. G.P. Bomb	Filler: 80/20 Tritonal
Total Weight: 250.0 Lbs.	Filler Weight: 131.0 Lbs.

<u>Frame in Which Hit Occurred</u>	<u>No. Fragments</u>	<u>Velocity (f/s)</u>
25	4	5830
26	5	5610
27	8	5400
28	7	5210
29	10	5030
30	2	4860
31	1	4700
34	3	4290
Median		5320
Average		5220

Electric Bomb Fuze EX 200 Mod 3 in 250 lb. Modified G.P. Bomb

TABLE I (Continued)

60 Ft. Radius Arena	Date Fired: 14 July 1952
35mm Fastax Camera #1	2580 frames per sec.
Rd. 2, 250 lb. G.P. Bomb	Filler: 80/20 Tritonal
Total Weight: 250.0 Lbs.	Filler Weight: 129.0 Lbs.

<u>Frame in Which Hit Occurred</u>	<u>No. Fragments</u>	<u>Velocity (f/s)</u>
25	3	6190
26	7	5950
27	12	5730
28	6	5530
29	2	5340
30	2	5160
31	1	4990
32	2	4840
Median		5770
Average		5650

Electric Bomb Fuze EX 200 Mod 3 in 250 lb. Modified G.P. Bomb

TABLE I (Continued)

60 Ft. Radius Arena	Date Fired: 14 July 1952
35mm Fastax Camera #2	2490 frames per sec.
Rd. 2, 250 lb. G.P. Bomb	Filler: 80/20 Tritonal
Total Weight: 250.0 Lbs.	Filler Weight: 129.0 Lbs.

<u>Frame in Which Hit Occurred</u>	<u>No. Fragments</u>	<u>Velocity (f/s)</u>
24	4	6230
25	8	5980
26	14	5750
27	4	5530
28	2	5340
29	1	5150
30	1	4980
Median		5870
Average		5770

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APPENDIX